

Facilities and Capabilities of ERDC's LAERF (Lewisville Aquatic Ecosystem Research Facility)

Presenter:

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Environmental Lab

Ecosystem Evaluation and Engineering Division

Aquatic Ecology and Invasive Species Branch

Environmental Stewardship Webinar Series

29 August 2019



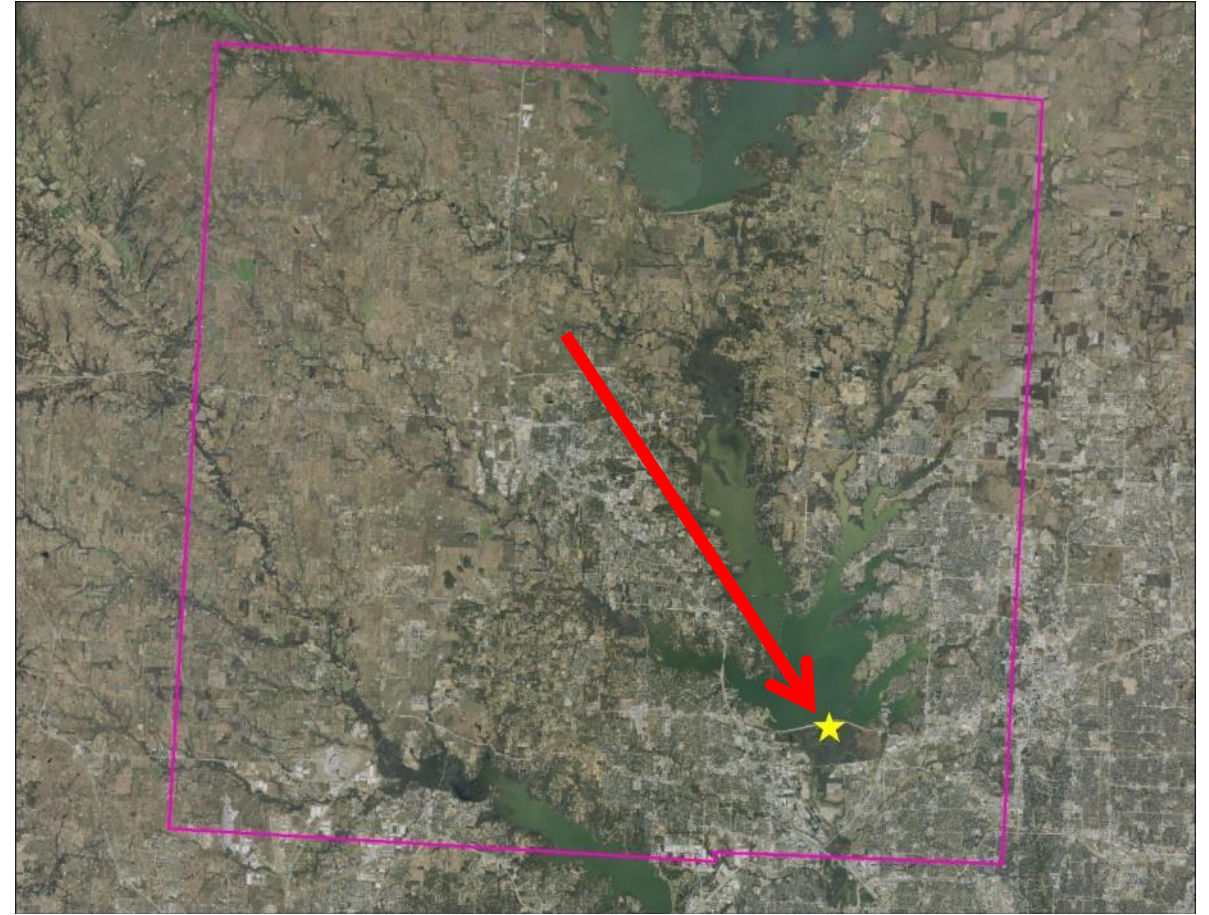
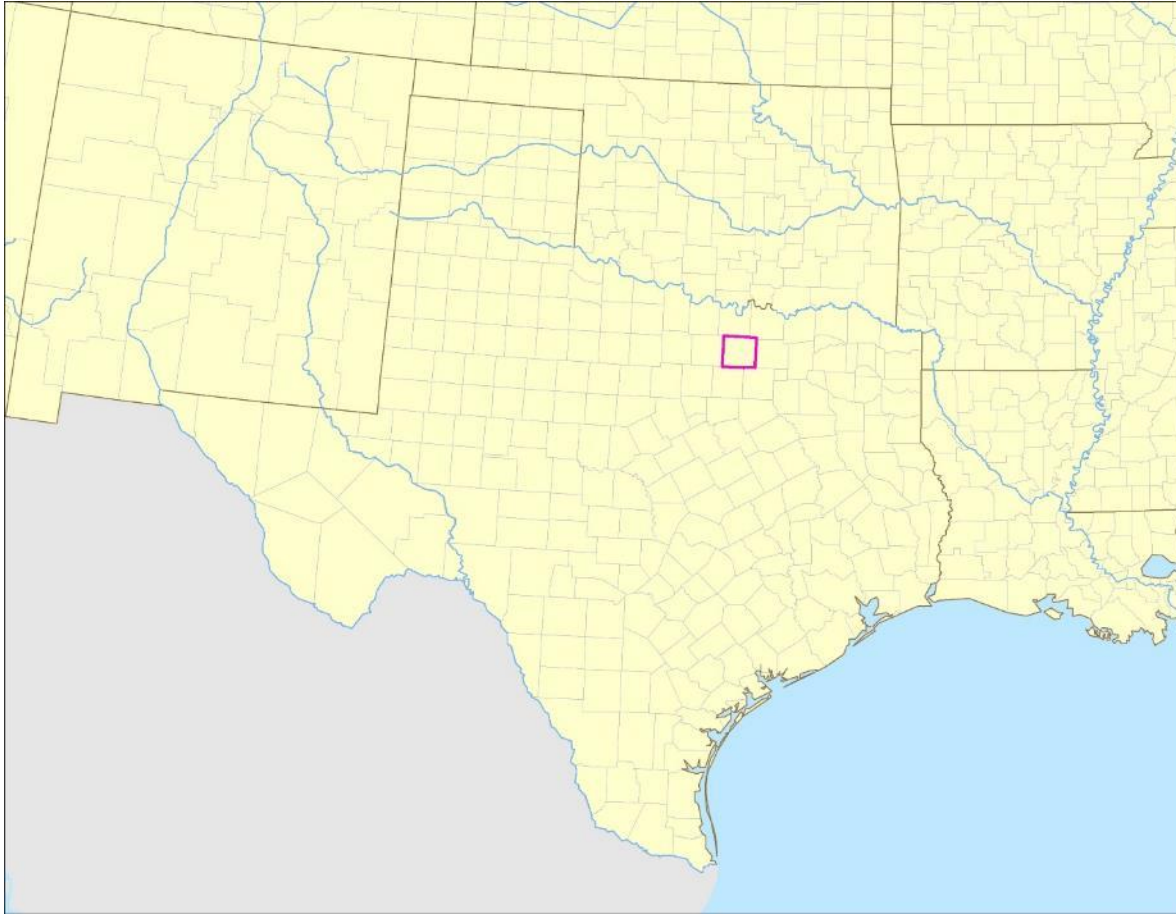
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Location



In 1988, ERDC, under an agreement with the Fort Worth District, acquired use of the 110-acre property formerly operated as a fish hatchery by TPWD.



LAERF in General

- LAERF supports studies on biology, ecology, and management of aquatic and wetland plants, serving as an intermediate-scale research environment to bridge the gap between laboratory studies and large-scale field tests.
- LAERF has also developed aquatic and wetland restoration capabilities to assist Districts and other state, local and Federal agencies with ecosystem management and restoration.



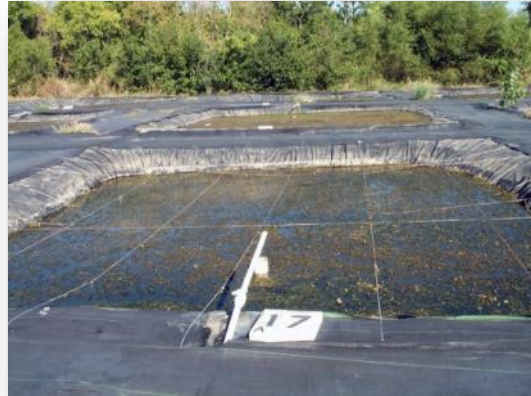
LAERF - Earthen Ponds

- 53 ponds available
- Volume - ~1,300 to 8,000 m³
- Surface area - 0.15 ha to 0.73 ha
- Mean depth - 1.1 m
- Water supply - gravity flow from Lewisville Lake
- Independent controls for filling and draining
- Easy access to the ponds
 - Gravel roadways encircle the facility
 - Wide levees surround the ponds
- Ponds used as testing areas prior to large-scale field applications



LAERF - Lined Ponds

- 21 lined, in-ground ponds
- Smaller than earthen ponds
 - 6 m by 6 m
 - 1.3 m deep
 - ~ 47 m³ in volume
- Pond sediments laid over bottom to enable rooting by aquatic plants
- Individual water control
 - Sand-filtered lake water
 - Unfiltered lake water
 - Maintaining depth with adjustable standpipes
- Ideal for replicated studies



LAERF - Mesocosm Systems

- Supplied with sand- (or cartridge) filtered, alum-treated lake water
- Most operated under static or flow-through conditions

- Twenty-four 1,845-L fiberglass tanks
 - 2.0 m diameter by 0.75 m deep
 - General biology and ecology studies
 - Grow out for cultured plants



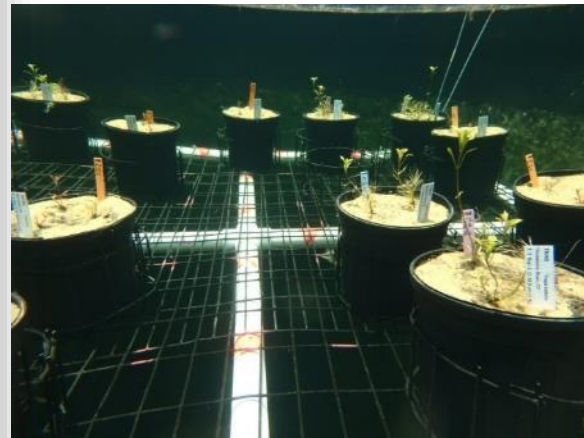
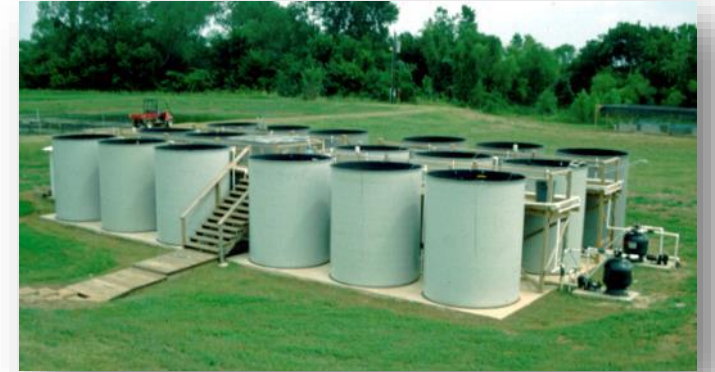
LAERF - Mesocosm Systems

- Thirty 6,000-L fiberglass tanks
 - 2.5 m diameter by 1.5 m deep
 - Deeper inundations and community effects
 - Herbicide impacts on target and non-target organisms



LAERF - Mesocosm Systems

- Eighteen 14,000-L fiberglass tanks
 - 2.5 m diameter by 3.0 m deep
 - Seasonal growth and development under low light conditions



LAERF - Greenhouses

- Seven greenhouses used for:
 - Replicated studies
 - Plant propagation
 - Overwintering of insects and plants
 - Maintenance of insect colonies
- Can be supplied with unfiltered or sand-filtered, alum-treated lake water
- Ambient or CO₂-amended air is supplied via air blowers and air stones



LAERF - Greenhouses

- Ecology Greenhouse contains six temperature-controlled water baths used to conduct replicated studies within 90% transparent cylindrical tanks
- LAERF Greenhouse houses twenty large temperature-controlled fiberglass tanks
- Two smaller greenhouses used for plant propagation and biocontrol projects
- Open-sided greenhouse with ten water baths
- Four plastic covered, cold frame greenhouses



LAERF - Laboratories

- On-site analytical laboratory equipped for:
 - Processing and analyzing water, plant, and sediment samples
 - Hydrolab™ units for long-term deployment or spot checking *in-situ* water quality data
- Four light and temperature controlled growth chambers are available for:
 - Seed germination and seedling development
 - Tuber/turion sprouting
 - Algae production



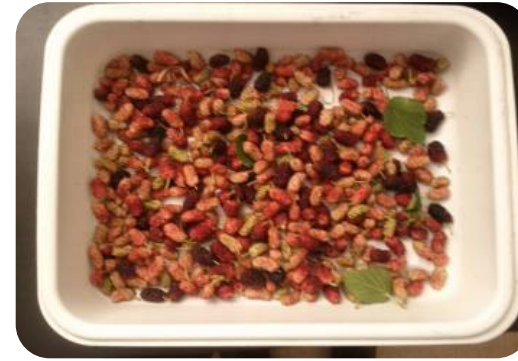
LAERF - Plant Nursery

- Large area dedicated for culturing a diverse set of native plants
 - Over 50 lined boxes of various dimensions and depths
- Aquatic and wetland species
 - Supplied with municipal water (dechlorinated)



LAERF - Plant Nursery

- Riparian grasses and woody plants
- Riparian nursery irrigated with sand-filtered, alum-treated lake water



LAERF - On-site and Remote Staff

- On-site: Dr. Gary O. Dick (Research Ecologist, DB-04)
 Ms. Lynde L. Dodd (Research Biologist, DB-04)
 Mrs. Julie G. Nachtrieb (Research Biologist, DB-04)
 Mr. Ricardo Luna (Research Biologist, DB-02)
 Mrs. Cindy Black (Administrative Assistant, IMRI Contractor)
 ORISE and Contract Students (4-6 at any given time)
- Off-site: Mr. Aaron N. Schad (Research Biologist, DB-02, San Antonio)

LAERF also collaborates closely with other ERDC researchers:

Nathan Harms (Research Biologist, DB-04)

Dr. Christopher Mudge (Research Biologist, DB-04)

LAERF - On-site and Remote Staff



LAERF – Capabilities and collaborations

- Conducting basic research on ecology of nuisance and native aquatic plants
- Planning, design, and implementation of aquatic ecosystem (lakes and wetlands) restoration
- Planning and implementation of invasive aquatic and riparian plant management
- Monitoring ecosystem responses to restoration and management activities
- Production or assistance in production of plant materials needed for ecosystem restoration
- Rearing, distributing, and monitoring release results of host-specific insect biological control agents
- Testing effects of aquatic herbicides on target and non-target aquatic and riparian plants

LAERF - Aquatic Ecosystem Restoration

- Feasibility, design, planning, construction, and operation of aquatic ecosystem restoration (lakes and wetlands)
- Focus is on vegetation community health
 - Establishing natives in unvegetated systems
 - Establishing and enhancing natives in conjunction with controlling nuisance plants in infested systems
- Benefits
 - Improved water quality
 - Improved/increased fish and wildlife habitat
 - Reduced shoreline erosion
 - Resistance to reinfestation



LAERF - Aquatic Ecosystem Restoration

Incorporates adaptive management to overcome plant establishment impediments and improve success:

- Herbivory
- Water level fluctuations
- Nuisance species management
- Other limitations as they occur



LAERF - Aquatic Ecosystem Restoration

- Develop methods to propagate and install native aquatic plants
- Improve techniques to produce robust mature plants
- Develop procedures for native plant establishment
 - Herbivore exclosures (cages) deter grazers, i.e. semi-aquatic turtles, carp, and waterfowl
 - Multiple plantings at multiple depths improve establishment success in fluctuating waterbodies
 - Target envelopes of expected water level regimes
- Provide assistance to other agencies in developing plant production capabilities



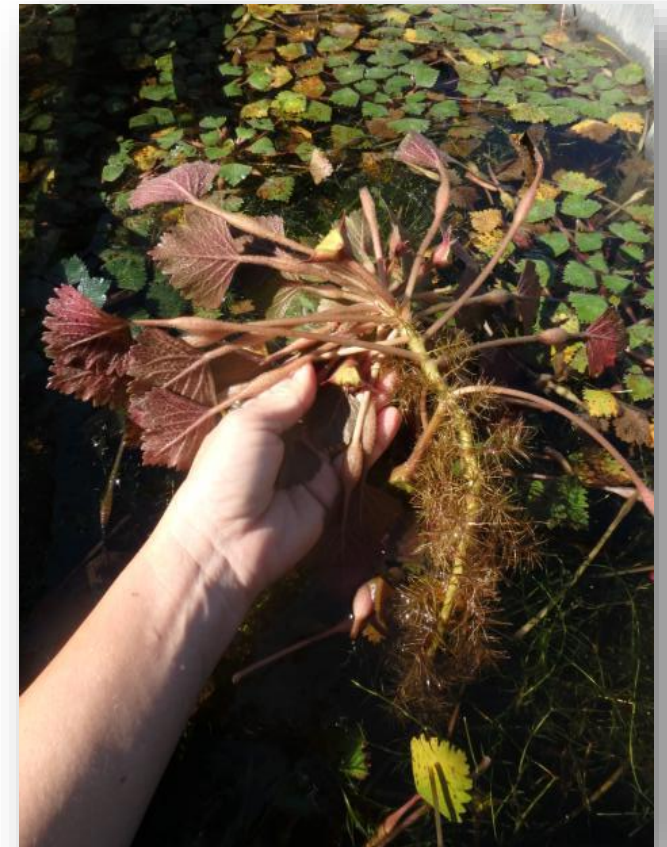
LAERF - Monitoring Ecosystem Response to Restoration and Management Activities - AM

- Evaluate successes/failures of native plant establishment efforts
- Evaluate efficacies of nuisance species management applications
- Evaluate overall plant community condition before, during, and after management
- Evaluate other biotic and abiotic ecosystem components, i.e. WQ, macroinvertebrates, birds, and other wildlife
- Use information from ongoing monitoring to rapidly formulate Adaptive Management responses, as needed



LAERF - Invasive Species Management

- Planning and design of invasive aquatic and riparian plant management
- Apply integrated, ecologically–based principles
 - Aquatic or otherwise appropriate herbicides for target species
 - Small-scale mechanical control (e.g., hand-weeding)
 - Large-scale mechanical control (e.g., mowing)
 - Water level manipulation (when possible)
 - Biological control agents (when available)
 - Niche filling - replace nuisance species with beneficial native species



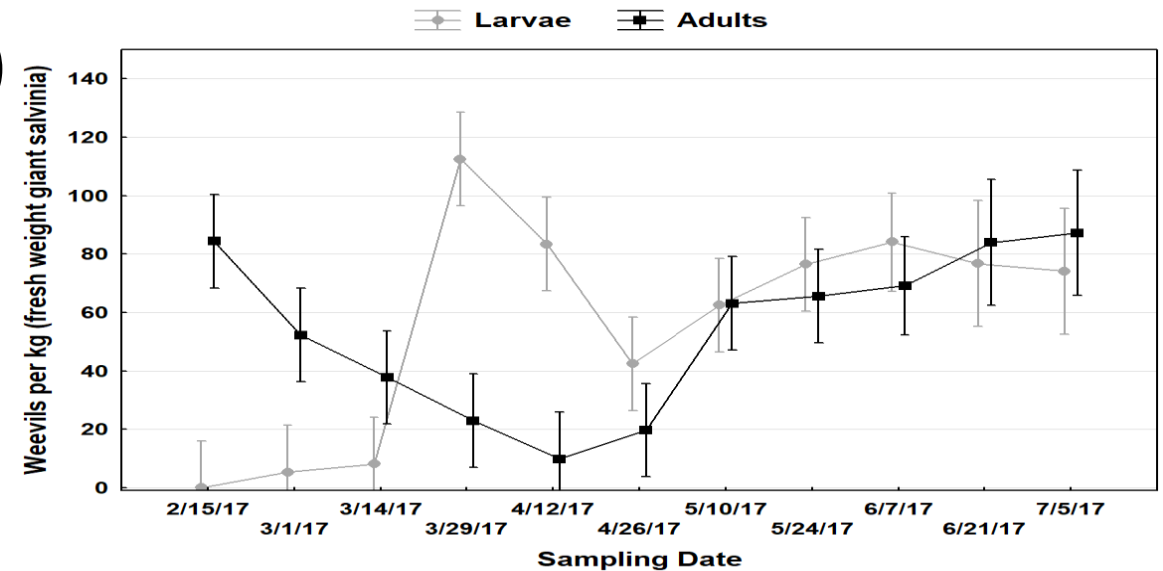
LAERF - Mass-Rearing of Insect Biocontrol Agents

- Able to mass-rear high numbers of quality insect agents at reasonable costs
- Historically - Hydrilla (*Hydrilla verticillata*); Alligatorweed (*Alternanthera philoxeroides*)
- Currently – Giant salvinia (*Salvinia molesta*)



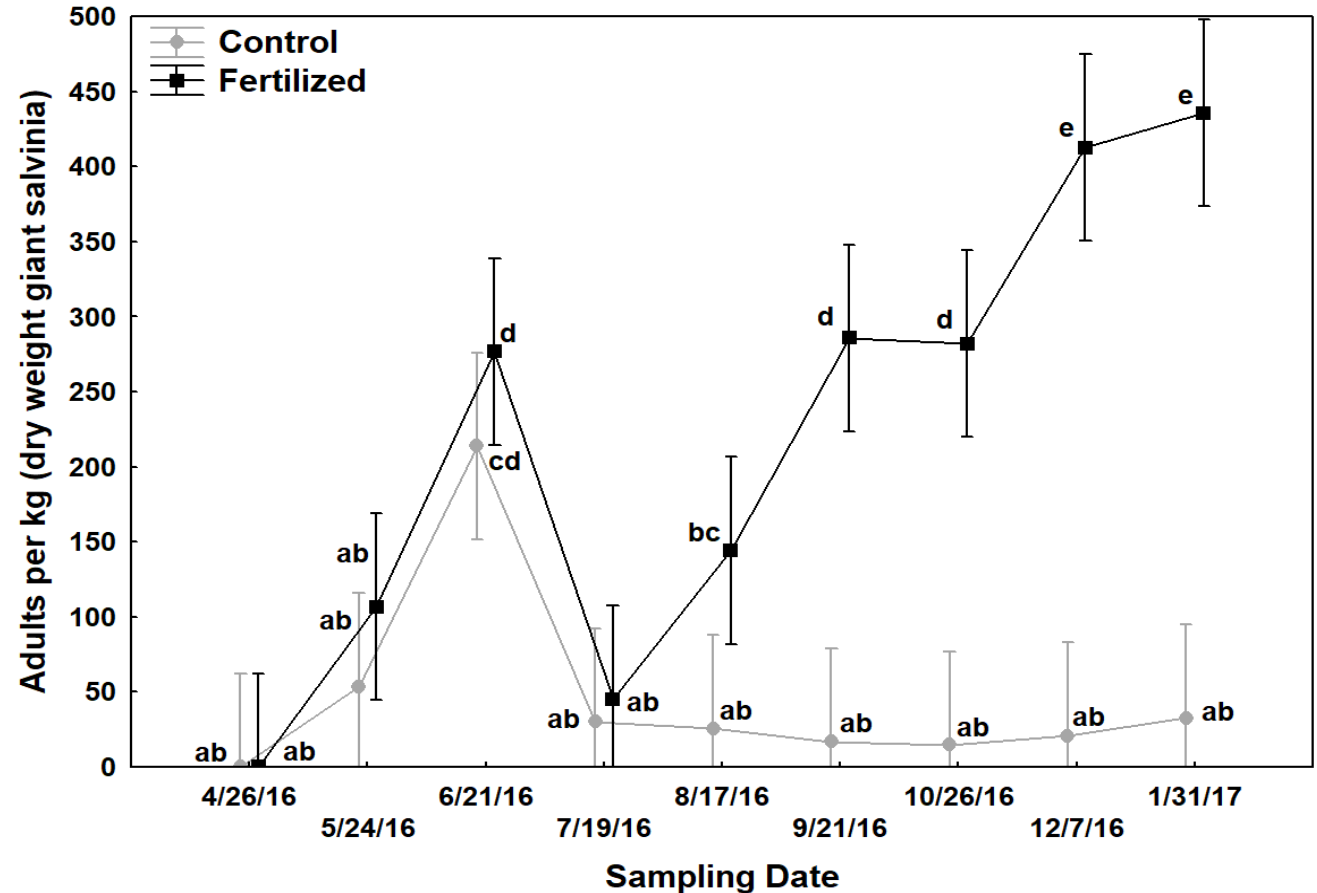
LAERF - Mass-Rearing of *Cyrtobagous salviniae*

- Salvinia weevil (*Cyrtobagous salviniae*)
 - Rearing, release, and field-site monitoring of biocontrol agents
 - Monitoring and categorization of host-plant damage
- Recent studies
 - Salvinia weevil population dynamics
 - Seasonal fluctuation between weevil life stages
 - Low temperature reproduction and larval survival



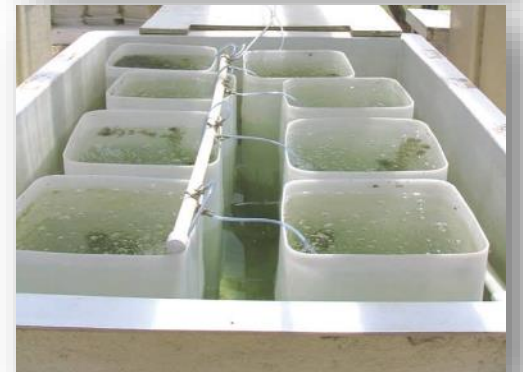
LAERF - Mass-Rearing of *Cyrtobagous salviniae*

- Recent studies cont.
 - Improvements to salvinia weevil establishment and giant salvinia management as a result of nitrogen amendments
 - Increases in plant nitrogen content lead to increased adult and larval weevil densities & increased management of infestation via biocontrol



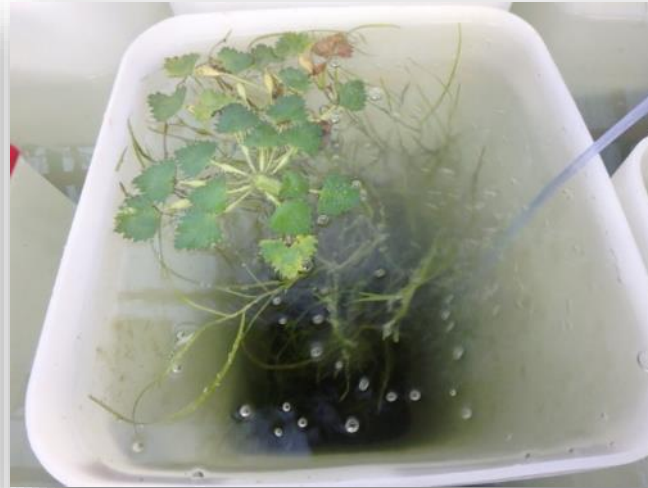
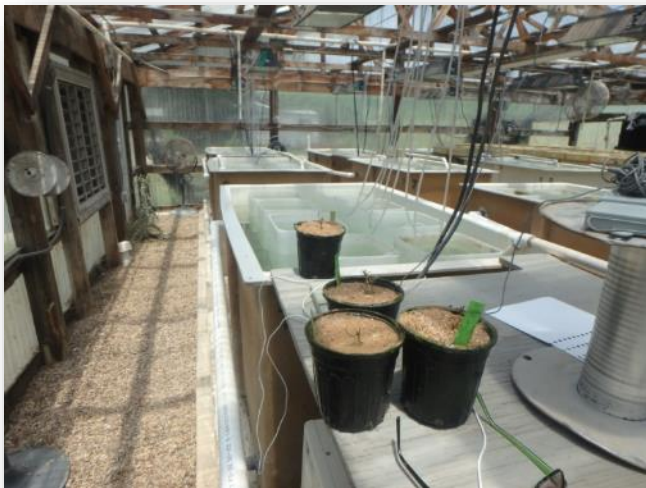
LAERF - Testing Effects of Herbicides

- Test new aquatic herbicides and application techniques:
 - Selectively remove nuisance vegetation
 - Protect desirable plants
 - Avoid degradation of water quality and aquatic habitat resulting from complete removal of aquatic vegetation
- Pioneer integrated management techniques including chemical and non-chemical methods
- Provide herbicide resistance management guidance
- Simulate herbicide CET relationships in aquatic systems with high water exchange characteristics
- Collaborative work with EL's Plant Management Team



LAERF - Current Research Projects

- Aquatic Plant Control Research Program ---- Management of Water Chestnut Work Unit – FY19-20; Co-PIs: ERDC's PM Team and USGS
 - Obj. 1 Herbicide screening trials to evaluate products with known and unknown activity on both *Trapa natans* and *Trapa bispinosa* naturalized in the NE US.



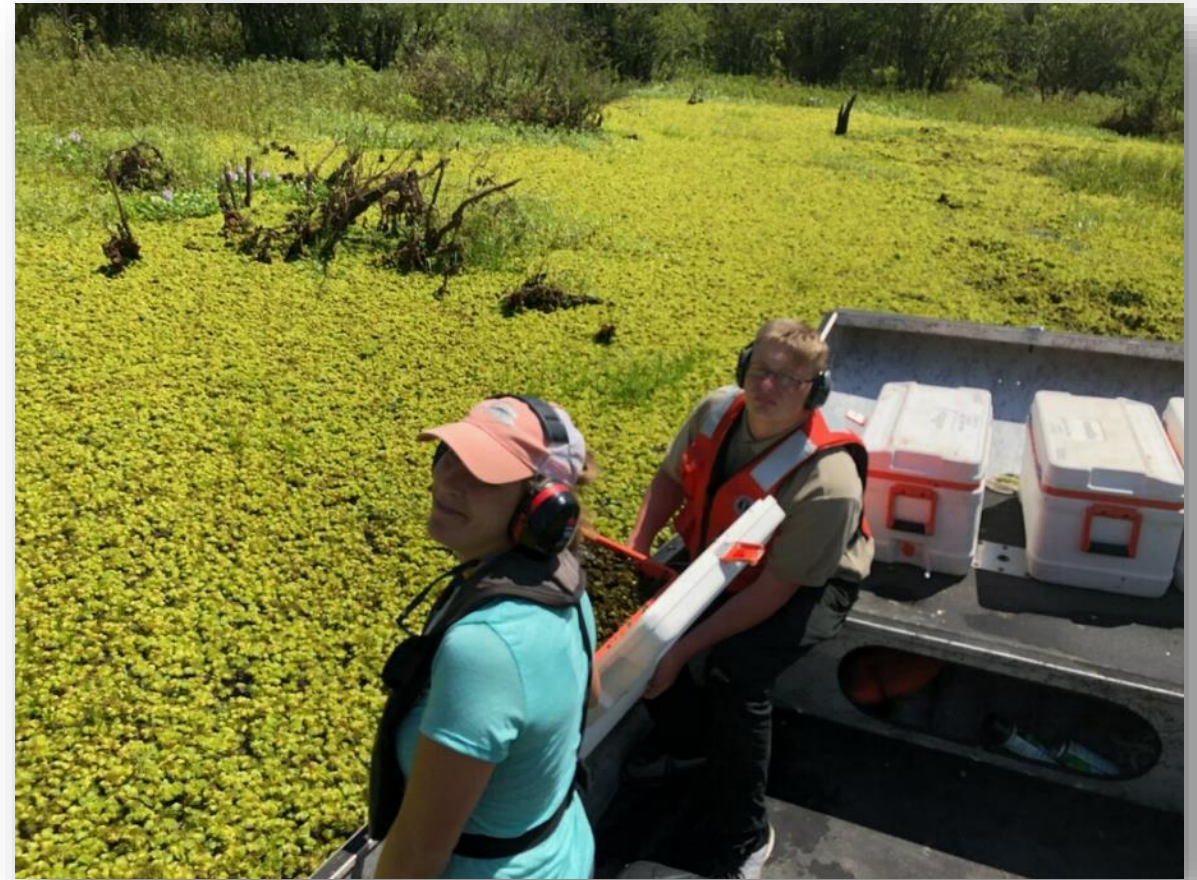
LAERF - Current Research Projects cont.

- Obj. 2 --- Evaluate seed bank response of water chestnut management (through seed bank analysis) on current populations of both *Trapa* species with varying degrees of mechanical and herbicide control strategies ranging from no management to extensive, multiple year control efforts



LAERF - Current Reimbursable Projects

- Invasive Species
 - *Cyrtobagous salviniae* mass-rearing for giant salvinia management
 - SWF
 - CRADA - Louisiana Department of Wildlife and Fisheries

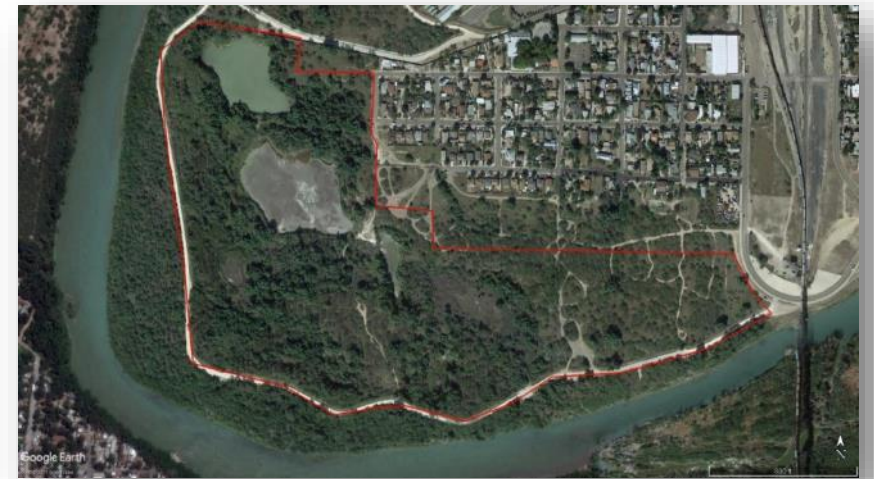


LAERF - Current Reimbursable Projects cont.

- Aquatic Ecosystem Restoration (GI, CAP, UMRRP, FRM, GLRI)
 - Provide assistance in planning, species suitability, and propagation
 - Implement vegetation establishment
 - Monitoring, AM, and O&M Manual
- Sponsors
 - CESWF (Fort Worth District)
 - **Dallas Floodway Extension** – Upper and Lower Chain of Wetlands
 - Central City – Sycamore Creek Oxbow Site A Mitigation
 - Lower Colorado River Basin (Onion and Timber Creeks), TX Flood Risk Management project
 - Lewisville Lake O&M – Reservoir Fisheries Habitat Partnership

LAERF - Current Reimbursable Projects cont.

- CESWG (Galveston District)
 - Resaca Boulevard Resaca Section 206 Ecosystem Restoration
 - Laredo Riverbend Section 206
 - Addicks Dam Safety Modification Mitigation
- CEMVP (Rock Island District)
 - Huron Island UMRRP Habitat Enhancement and Rehabilitation Project



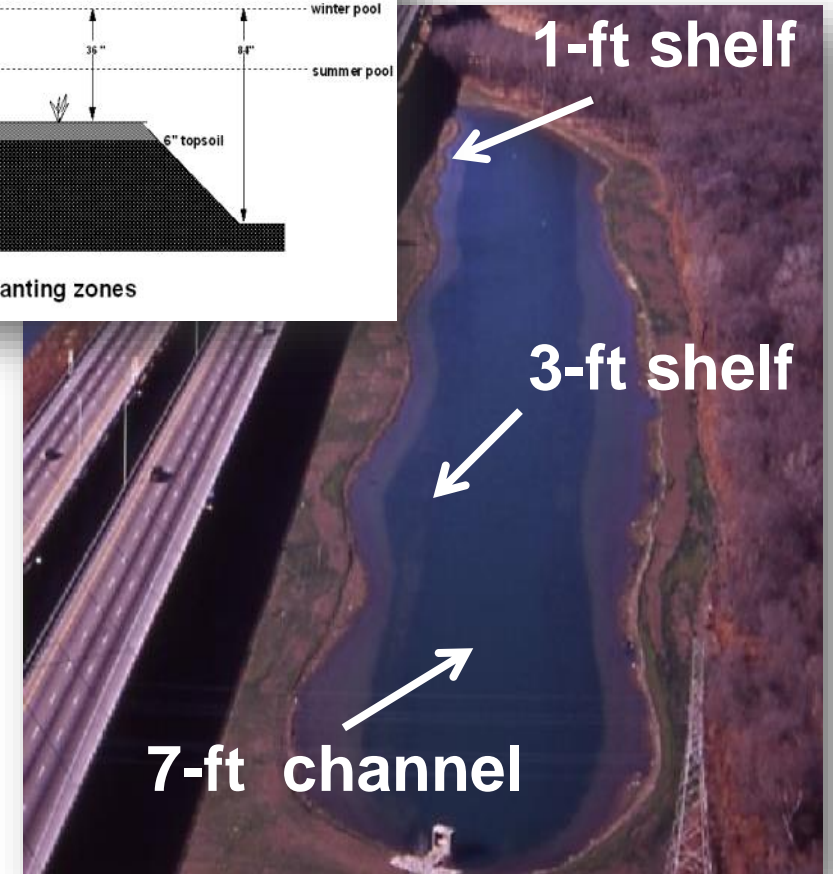
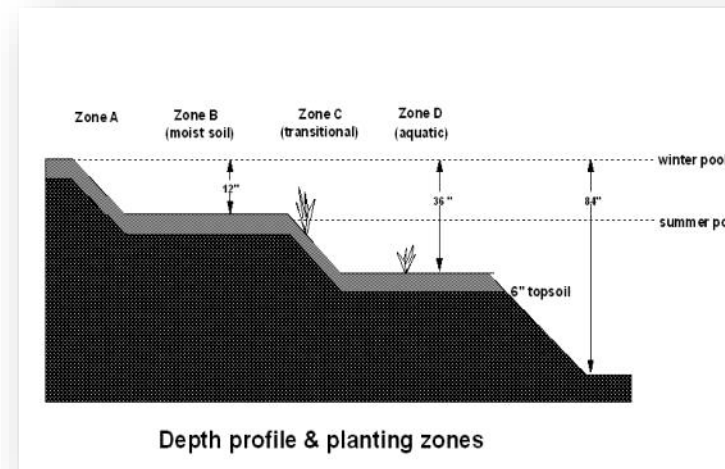
LAERF - The Dallas Floodway Extension

- Authorized in 1965 by Section 301 of the Rivers and Harbor Act authorized; modified by Section(s) 351/356 of Water Resources Development Act(s) of 1996/1999; construction began 2001
- Amended to include environmental & recreational components
- Sponsor: City of Dallas, Texas; SWF requested assistance from ERDC
- Focus areas: Flood protection, Ecosystem Restoration, Recreation



LAERF – DFE Design and Function of the Wetlands

- What does an aquatic plant want?
 - LAERF worked closely with SWF Planning to design a system conducive to wetland plant growth
- Cells constructed aquatic/wetland plants and flow
 - 1-ft shelf --- mixed grassland & wetland plants – moist soil
 - 3-ft shelf --- wetland & aquatic plants
 - 7-ft channel --- open water (& flood conveyance)



LAERF – DFE Hydrology - Challenges

- Too little water to wetlands
 - Pump malfunction; weir gate vandalism
 - Delays in repairs – sometimes for months
 - Water loss during the wrong time of the year, i.e. mid-summer
- Too much water
 - Stormwater/overbanking
 - 13 of the top 120 historic crests since 1908 occurred



LAERF – DFE Hydrology – Overcoming Challenges

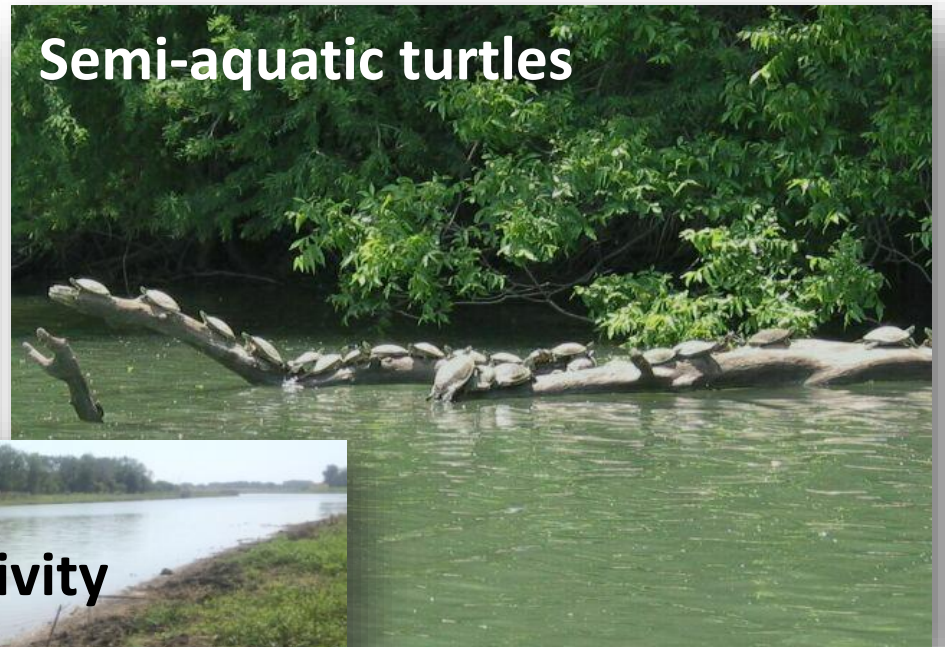
- Include species that can tolerate adverse conditions; diversity is key
 - Promote desirable volunteer annuals
 - Choose hardy perennial species able to tolerate drought or prolonged inundation; tuber producers and/or rhizomatic species
 - Go with what works! Use reference wetland plant associations!
- Monitor closely the effects of water level manipulations on vegetation, what worked last year may not work this year



Herbivory



Geese



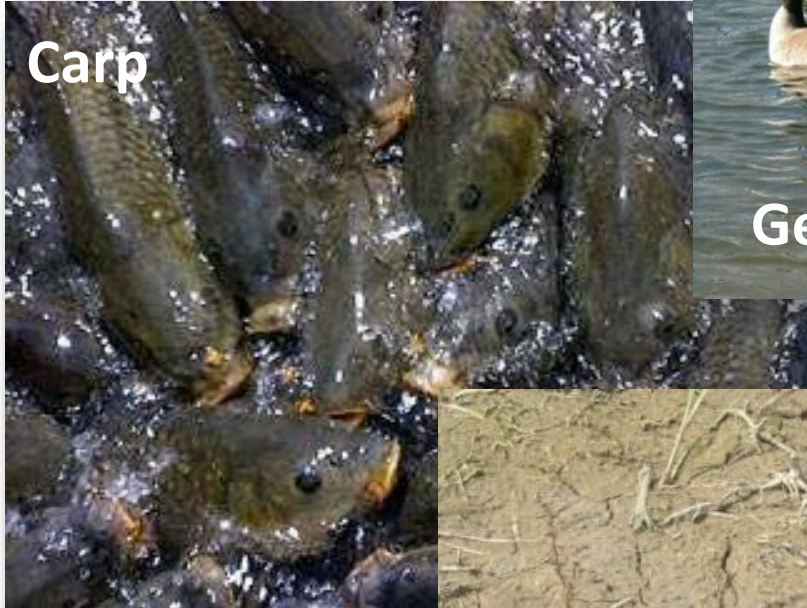
Semi-aquatic turtles



Feral hog activity



Nutria



Carp



Crayfish

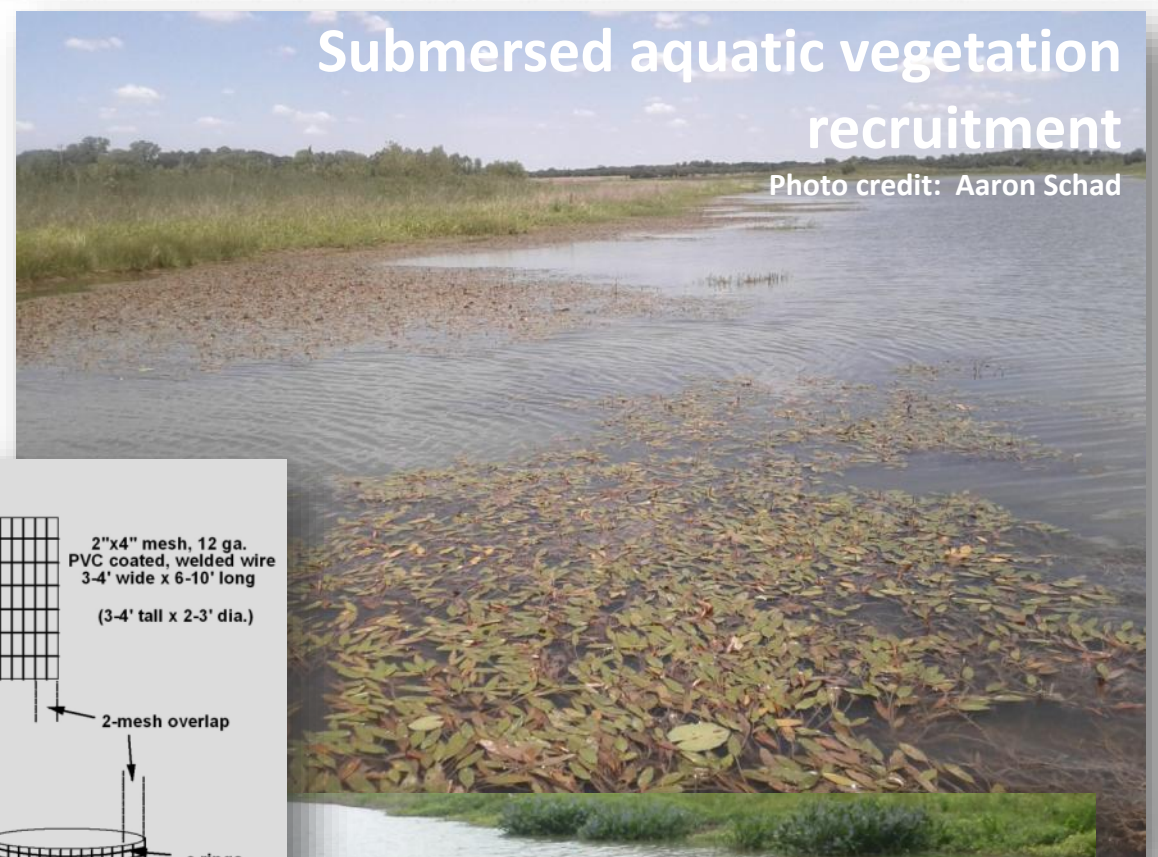
Submersed aquatic vegetation establishment in exclosures

Photo credit: Aaron Schad

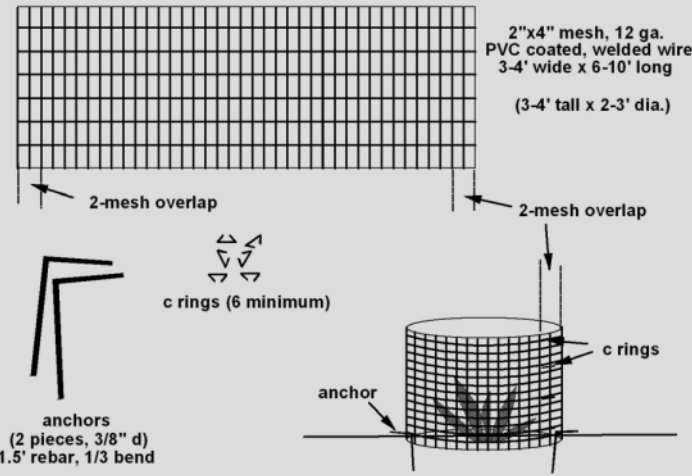


Submersed aquatic vegetation recruitment

Photo credit: Aaron Schad



Winter plantings



Emergent vegetation

LAERF Benefits USACE

- LAERF provides facilities that promote aquatic ecology research that is both applied and foundational
- LAERF collaborations include national and international agencies
- LAERF supports USACE's water resource managers commitment to protecting our Nation's water resources across all business lines of Flood Risk Management, Navigation, and Environment

More information on LAERF

Email Lynde Dodd Lynde.L.Dodd@usace.army.mil



Requesting help from ERDC --- WOTS, DOTS, and SONS, Oh My!!!

Water Operations Technical Support Program

<https://wots.el.erdcdren.mil/>

Dredging Operations Technical Support Program

<https://dots.el.erdcdren.mil/>

Water Operations Technical Support Program

U.S. Army Corps of Engineers | Engineer Research and Development Center | Environmental Laboratory

Program Manager: [Pat Deliman](#)

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Webdate: March 1, 2009
Updated: August 2016

U.S. Army Corps of Engineers
Engineer Research and Development Center
Dredging Operations Technical Support Program

Knowledge base + Submit a DOTS Request Contact Us

USACE / ERDC / EL / DOTS Friday, August 23, 2019

Quick Link **DOTS**

SUBMIT A DOTS REQUEST

Introduction to Dredging Operations Technical Support (DOTS) Program
from ERDC Corporate Communications

Discover

Webinars
14 August 2019, 1:00 PM CDT - Leveraging Technology to Prevent Looting and Destruction

The ERDC Dredging Operations Technical Support Program (DOTS) provides environmental and engineering technical support to the U.S.

Statement of Need or SON

How are SONs used and developed? Statements of Need (SONs) are essentially communication tools. Within the USACE organization, **SONs bridge between the experiences of the field practitioners**, the strategic vision of Headquarters and the Communities of Practice, and the research programs that provide support to the field through the USACE research facilities and their many collaborators.

SoNs serve specifically to communicate issues presenting an impediment to efficient and effective mission execution, thus informing the **necessary research, practice, and policy and guidance development needed for resolution**. SONs consist of concise descriptions of mission execution challenges that may need to be addressed through specifically targeted research efforts, and inform subsequent action by USACE leadership, Community of Practice (CoP) leads, Business Line managers, Research Area Review Groups (RARGs) and the Research Community.

Research efforts described by a SON may be directed, for example, to improving our understanding of **physical and ecological processes and relationships**, to the development of **modeling and planning tools**, or to the acquisition of data informing development of **guidance or policy documents**.

Visit <https://cw-environment.erd.c.dren.mil/cwenv.cfm>

Click on the R&D Statements of Need link under Quick Links

The screenshot shows the Civil Works Environment Gateway website. A red arrow points to the URL bar containing <https://cw-environment.erd.c.dren.mil/cwenv.cfm>. Another red arrow points to the 'R&D Statements of Need' link in the Quick Links section. The website header includes the US Army Corps of Engineers logo and navigation links: Home, Visitors, People, Forums, Learning, Tools/Resources, News/Events, Submit, Search/Index. The main content area features a 'Civil Works Environment Notes' section with a welcome message and a 'Recent Web Meetings' link. Below this are sections for 'Communities of Practice', 'Key Environmental Links', 'Business Process', 'Quick Links', 'Contacts', and 'Discussion Forums'. The 'Quick Links' section lists various resources, including 'R&D Statements of Need'. At the bottom, there are sections for 'Civil Works Environment Community Headlines' and 'Corps of Engineers News'.

Questions?

More information on LAERF:

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Water Operations Technical Support Program

<https://wots.el.erdc.dren.mil/>

Dredging Operations Technical Support Program

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